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ABSTRACT

Project Discovery II was based on a previous highly successful Fund for the Improvement of Postsecondary Education (FIPSE) project called Project Discovery. Teams of high school teachers and college faculty in the project planned and implemented an integrated, discovery based curriculum with groups of block-programmed students in New York City public high schools to keep them on line in academic programs so that they could enter college without need for remediation. The first project targeted average students; the present project worked exclusively with below-average students, focusing on 4 classes of 30 to 35 students each. The program achieved moderate success in significantly improving attendance rates and, by the third year, grades. Deterrents to greater success included various school practices such as assignment of teachers and class scheduling without regard to the welfare of below-average students, but the major obstacle was the lack of basic skills among these students. The project was a major success in raising the morale of participating teachers. An evaluation of the project and interviews with participating teachers by David M. Podell are attached. (Contains five tables and four figures.) (Author/SLD)

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FIPSE Project Discovery II

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THE COLLEGE OF STATEN ISLAND
THE CITY UNIVERSITY OF NEW YORK

Grantee Organization: College of Staten Island
Discovery Center
2800 Victory Boulevard
Room 1A-211
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Grant Number: P116B30219

Project Dates: Starting Date: September 1, 1993
Ending Date: August 31, 1996
Number of Months: 36

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FIPSE Program Officer: John E. Donahue

Grant Award:

Year 1	$ 97,749
Year 2	$111,211
Year 3	$105,376
Total	$314,336

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Paragraph Summarizing the Project

Project Discovery II was based on a previous highly successful FIPSE project called Project Discovery in which teams of high school teachers and college faculty planned and implemented an integrated, discovery based curriculum with groups of block programmed students in New York City public high schools to keep them on line in academic programs so they could enter college without need for remediaton. The first project targeted average students; the present project worked exclusively with below average students. It achieved moderate success in significantly improving attendance rates and, by the third year, grades. Deterrents to greater success included various school practices such as assignment of teachers and class scheduling without regard to the welfare of below average students; but the major obstacle was the lack of basic skills among these students. The project was a major success in raising the morale of participating teachers.

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Project Discovery II

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Executive Summary

Project Discovery II
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A. Project Overview:

Project Discovery II was modeled on an earlier FIPSE project, Project Discovery, in which teams of high school teachers and college faculty worked with groups of block programmed students in representative New York City high schools. The goal of this earlier project was to take "average" students who entered high school "on line" in a college preparatory track and to keep them on line so they could enter college without need for remediation.

The means for reaching this goal was the development and implementation of curricula that would interest the students in two ways, one through the development of discovery based activities that would engage the students actively in their own learning, the other through integrating the four major subjects of math, science, English and social studies around common themes that would relate to the students' natural interests.

This project worked so well in one of the schools that a second project was proposed, funded by FIPSE, and first implemented for the 1993-1994 school year. This is Project Discovery II, which is being reported on here. Project Discovery II resembled the first Project Discovery in almost every way except for one significant feature: The students selected for Project Discovery II were not average, on line students, but students who entered high school below average in basic skills.

This difference proved to be much more significant than anticipated. A variety of problems stemming from the reality that Project Discovery II addressed itself to below average students obstructed the project and resulted in rather modest positive results for the participating students. Much was learned from this project, however, which might contribute to a more positive outcome in future attempts to reach these below average students.

B. Purpose

The problem in higher education which this project addressed was the lack of preparedness for college among many high school graduates. The problem behind this problem, of course, is that of underachievement among high school students. The project directors, while acknowledging the adverse impact of factors such as poverty, single parent families, teen pregnancy, social pressures, and other deterrents to academic achievement among American adolescents, began from the assumption

that, even if all of these negative factors could be eliminated, a central obstacle to academic success would remain. Further, they assumed that this central obstacle constitutes the core of the problem, or at least the core that schools can do anything about. This is that large numbers of American youth experience alienation from what goes on in the high school classroom. Put simply, students are bored.

As indicated elsewhere, while the program based on this assumption proved highly successful in the first Project Discovery, it was less so in Project Discovery II, necessitating a partial revision of the Project Directors' definition of the problem. With below average students the problem is not just boredom. It is also lack of basic learning skills as well as the structure of the school which militates against their success. Further efforts to raise achievement among below average students should take these additional factors into account from the beginning.

C. Background and Origins

As indicated above, this project had its origins in a previous FIPSE project which was highly successful at Curtis High School on Staten Island with average students. Because of enthusiasm at Curtis after the success of the first project, and because the school already had a cadre of teachers experienced in the approach, it was hoped that essentially the same program could work with below average students in this school. However, given the admitted major differences in achievement and motivation between the Project Discovery I and Project Discovery II student populations, it was recognized that adaptations, even major changes in the original project would have to be made. In English, different readings had to be selected. Social studies and even science and math teachers had to learn how to assist in developing students' reading and writing skills within their regular courses. Developmental math had to be included into the curriculum to bring students up to level.

D. Project Description

Project Discovery II was organized and implemented along the same lines as the original Project. The specific plan of implementation was as follows:

In the first year a team consisting of the two Project directors from The College of Staten Island; four master teachers from Curtis High School already skilled in the Project Discovery approach, representing each of the four disciplines of Biology, Mathematics, Social Studies, and English; and eight additional teachers, two from each discipline, spent twenty days in August developing integrative units based on the discovery method as described above. The team worked with the math and reading/writing consultants to incorporate skills development into the exercises. In September the teachers began to implement these units with 4 classes of freshmen (30-35 students in each class). The students were selected at random from among those entering Curtis High School with below average reading and math scores. They were to be block programmed into the same core Regents level academic courses, and the teachers worked as a team representing the four academic subjects. The College's experts in reading, writing, and math remediation were to work with the

teachers on a periodic basis.

Twice a month during the school year the College members of the team and the teachers held a two hour meeting after school to exchange ideas, assess progress, and modify or further develop programs as needed.

This procedure was to be repeated in a second and third year, with additional teachers and students added each year to include the sophomore and junior years.

E. Evaluations/Project Results

From the beginning and throughout the project a variety of problems stemming from the reality that Project Discovery II addressed itself to below average students were incurred which appear to help explain why these students fail and which seriously obstructed the smooth running of the project. These obstacles included the fact that the least motivated and/or least experienced teachers tended to be assigned to these students; that they were programmed for their important courses at the least desirable times of the day; that they were often moved from one class section to another for merely administrative reasons, thus undermining the block programming; that their math skills covered such a broad range that they could not be block programmed in math; that their basic language arts skills were so weak that the project directors underestimated what would be needed to bring them up to grade level; and that the school's worst troublemakers tended to find their way into these classes, causing disruption.

Despite these persistent difficulties, Project Discovery II students consistently attended school more regularly than the control group, suggesting that they found the project-developed classroom activities more interesting. By the third year, when many of the obstacles had been overcome, Discovery students' grades were also substantially superior to the control group, suggesting a long-term positive effect.

Perhaps most significantly, the teacher participants unanimously found the project a turning point in their careers, and experienced high levels of enthusiasm and renewal of their commitment to teaching. The enthusiasm was shared by the principal.

This has led to a dedication of the school to continue the integrative, discovery approach in an organized manner, this time including for below average students a thorough basic skills package developed by the teachers based on the discovery approach.

F. Summary and Conclusions

Project Discovery II appears to have worked with the target students, but with far less dramatic success than its predecessor. Of the reasons for the diminished success that future efforts might be able to remedy, very important would be a more concerted effort to deal with basic skills, ideally in the pre-high school years. Of equal importance would be a remedy for the second class treatment below average students tend to receive: the worst teachers, the worst schedules, lack of programmatic stability, victimization by the school's worst troublemakers, etc.

The Project has clearly been effective as an instrument of teacher renewal.

Body of Report

Project Overview

Project Discovery II was modeled on an earlier FIPSE project, Project Discovery, in which teams of high school teachers and college faculty worked with groups of block programmed students in two New York City high schools. The goal of this earlier project was to take "average" students who entered high school "on line" in a college preparatory track and to keep them on line so they could enter college or the work force without need for remediation, thus reversing the prevailing pattern in NYC high schools in which only about 15% of such students graduate with an academic diploma. The means for reaching this goal was the development and implementation of curricula that would interest the students in two ways, one through the development of discovery based activities that would engage the students actively in their own learning, the other through integrating the four major subjects of math, science, English and social studies around common themes that would relate to the students' natural interests.

This project worked so well in one of the schools that a second project was proposed, funded by FIPSE, and first implemented for the 1993-1994 school year. This is Project Discovery II, which is being reported on here. Project Discovery II resembled the first Project Discovery in almost every way except for one significant feature: The students selected for Project Discovery II were not average, on line students, but students who entered high school below average in basic skills.

This difference proved to be much more significant than anticipated. A variety of problems stemming from the reality that Project Discovery II addressed itself to below average students obstructed the project and resulted in rather modest positive results for the participating students. Much was learned from this project, however, which might contribute to a more positive outcome in future attempts to reach these below average students.

Purpose

The problem in higher education which this project addressed was the lack of preparedness for college among many high school graduates. In New York City, for example, 85% of the students who begin in the academic (Regents) track drop out of this program and graduate without a "Regents" diploma, unprepared for college and even for skilled employment. Since many of these students go on to college anyway, the impact of this phenomenon on higher education, especially open enrollment universities, has been devastating. Currently, for example, the College of Staten Island has to offer 120 sections of remedial mathematics yearly, fully 50% of its total mathematics offerings, just to prepare incoming students for a required college level mathematics course. The English Department offers 78 sections of remedial writing and reading courses, just to prepare incoming students for a basic college level composition course. The remedial courses are fully 38% of all the courses in composition. This situation is typical of colleges within the City University of New York

system and of open access colleges and universities throughout the Unites States. This huge expenditure of time and money on remediation in American higher education results directly from the failure of the country's adolescents to achieve academic success in high school. The goal of Project Discovery, therefore, has been to deal with this problem by keeping high school students "on line" in the New York State academic program.

The achievement of this goal required the identification and analysis of the problem's fundamental root, which, of course, is the problem of underachievement among high school students. Why do so many high school students abandon the academic track? The project directors, while acknowledging the adverse impact of factors such as poverty, single parent families, teen pregnancy, social pressures, and other deterrents to academic achievement among American adolescents, began from the assumption that, even if all of these negative factors could be eliminated, a central obstacle to academic success would remain. Further, they assumed that this central obstacle constitutes the core of the problem, or at least the core that schools can do anything about. This is that large numbers of American youth experience alienation from what goes on in the high school classroom. Put simply and bluntly, students are bored. This fact has been repeatedly documented by major studies of the American school for over half a century, from Willard Waller's classic, The Sociology of Teaching, in 1932 to John Goodlad's A Place Called School in 1984. The average American high school student does not find what takes place in the typical school classroom interesting, satisfying, or meaningful.

The Project's thrust, therefore, was primarily curricular. It began from the assumption that a better constructed, better taught curriculum would make substantial inroads into the problem outlined above. In Project Discovery I this assumption was strongly confirmed, as a renewed integrated, discovery-based curriculum made a dramatic difference in the achievement and retention on line of average high school students. The one significant refinement from the Project Discovery I experience was that the degree of teacher enthusiasm, not just the new curriculum itself, was key to success. The degree to which teachers redeveloped the curriculum themselves and made it their own made a substantial difference in student success.

This refinement was explicitly incorporated into Project Discovery II, as teachers took ownership of curriculum development, and created unique sets of integrated, discovery based activities within New York State curricular guidelines. The fact that teacher-developed, integrated, discovery based curricula had only a modest positive effect on the below average students who were the target population in Project Discovery II has led to a certain redefinition of the fundamental problem. That is, it now appears that the problem of student underachievement may be appreciably different for below average students than for others. The difference probably stems from three different but interrelated sources:

1. One is the probability that negative influences outside of school are greater for below average students. All the evidence points in this direction. However, this factor lies beyond the scope of Project Discovery II.
2. A second is that the very organization and structure of schools militates

against the success of below average students, who tend to be assigned the most inexperienced and/or least motivated teachers and the worst time slots for their most important classes, while they are forced to endure the school's worst troublemakers and are moved arbitrarily from one class to another to satisfy logistical rather than educational needs. Attempts were made to adapt Project Discovery II to these factors, and these are more fully discussed in **Evaluation/Project Results** below.

3. A third is that below average high school students do not benefit as much from a reinvigorated academic curriculum because they have not yet acquired the basic skills they were presumed to have brought with them to high school. The importance of this factor emerged more slowly during the progress of Project Discovery II, and is discussed more fully below, particularly in plans for continuation.

Background and Origins

This project was the outgrowth of and a significant new direction in a program called Project Discovery, co-directed by two College of Staten Island (CUNY) professors at Curtis High School, Staten Island, and Fort Hamilton High School, Brooklyn, New York. Project Discovery began in 1988 as a pilot at Curtis High School, was funded from 1990 to 1993 for both schools by the Fund for the Improvement of Post Secondary Education. The Project's target was the "average" high school student who enters at grade level and is programmed into the academic track, in New York State known as the "Regents" track which requires that students must complete courses AND pass state-wide tests in three years of "sequential" mathematics which include algebra, geometry, and trigonometry; two years of science taken from biology, chemistry, physics; three years of a foreign language; two years of global studies; two years of American history and government; and four years of English. At Curtis and Fort Hamilton High Schools, typical of public high schools in New York City, only about 15% of graduating students actually complete this program. The rest fall into a non-academic "general education" track.

Therefore, the goal of this first Project Discovery was to keep a significantly higher proportion of these average students on track in the academic program. The method of achieving this goal was based on the project directors' convictions that a fundamental reason for the problem was that most students are uninterested in and bored by what goes on in the typical classroom. To counteract the reality that students find their courses uninteresting, the Project's co-directors worked intensively with teams of high school teachers to develop curricula, within state guidelines, that appeal to average students as meaningful and satisfying. They took seriously two widely acclaimed but rarely practiced pedagogical principles:

1. First, the participants attempted to implement what educational philosophers and psychologists have long been saying, and what many educators affirm but few put into practice, namely, that students learn best by DISCOVERY, actively engaged in their own learning. Therefore, the emphasis in all courses was placed not on conclusions to which scholars have already arrived, but on the

questions that lead to investigation in the first place, and the processes by which discovery is made and insight gained. For example, at present the typical New York City Regents Biology course allocates one sixth of class time to laboratory work and five sixths to lectures and presentations filled with a vast array of biological facts required by the State-mandated Regents curriculum. The need to "cover the facts" has inexorably pushed teachers to stress these facts and view the laboratory work as time lost from "teaching." But Project Discovery reversed this allocation and devoted the major portion of time to discovery-oriented laboratory investigation, which heightened student interest and produced dramatically better results on the State Regents Biology examinations. This was effected by selecting a series of experiments which parallel and illustrate the mandated curriculum and at the same time relate to the students' interests.

2. Second, the project took seriously another weakness which has often been pointed out in the school curriculum. That is its fragmentation. Students go from one intellectually segregated class to another, seldom if ever experiencing any connection between literature and science, or even between science and math, not to mention social studies. The project made a concerted effort towards the INTEGRATION of all subject matter in the four academic Regents courses included in the program: Science, Mathematics, Global Studies, and English. At each grade level themes have been developed which link each subject with all the others. One such theme, for example, makes explicit the analogies between biological systems within living bodies and social systems among human beings, connecting Biology and Social Studies in a truly intellectual way. Thus, the project stressed the INTEGRATION of the high school subjects, developing interrelating themes between science, math, English, and social studies, and the implementation of these themes through DISCOVERY activities.

Because this endeavor, particularly the integration of curricula, requires so much cooperative effort, the teachers were organized into teams consisting of one teacher from each subject area. Each team engaged in intensive planning with the project directors during the summer and was then assigned to a group of block programmed students. Planning and evaluation of progress continued through the school year in twice monthly after school seminars. The students began the program as freshmen and continued through junior year, and teams of teachers were developed for each year.

The results of this project were extremely gratifying, particularly at Curtis High School where the program, including the pilot project, had run for five years by the end of FIPSE funding. Of the students at Curtis who began in the pilot project, all but one graduated on time with a Regents academic diploma. Only 55% of a matched control group graduated on time, many of these with General Equivalency Diplomas (GED), and only 15% with a Regents diploma. Of the students who began as freshmen in the FIPSE funded program, 95% were still on the Regents track,

compared to 45% of the control group, and were passing over 95% of their courses, compared to only 75% for the control group. Class attendance for participating students was an astounding 95%; for the control group less than 80%. Tests of critical thinking skills indicated that in one year Project Discovery students improved at more than twice the control group's rate.

In addition, remarkable changes in attitude and behavior were measured in the Project Discovery teachers. In the early years they largely depended on the Project directors for integrating themes and discovery based activities. But gradually they took rightful ownership of the program, and turned summer planning sessions into animated, creative, even electrifying exchanges, which continued during the school year. According to one evaluation of the program, the teachers "reported that the greatest strength of the program was the coordinated team effort among the teachers across academic disciplines. The brainstorming process used to make curricular decisions resulted in the teachers feeling invested in the program."

It was this background of the pilot project and the first FIPSE project with average students which led to the proposal for Project Discovery II, which was conceived of as identical in form and philosophy, but different in that it would target the more challenging population of below average students and that it would be limited to Curtis High School which seemed more fertile ground for this more difficult experiment.

The group of youth who enter Curtis High School below grade level in language arts and mathematics accounts for almost two thirds of the student body, and is made up of 43% minority students, the overwhelming majority (90+%) from poverty level conditions, many living in public housing projects, and almost half destined to drop out before graduation.

Several factors led to the hope that Project Discovery could succeed with this group of students. One was the remarkable success, noted above, with "on line" students. A second was the enthusiasm, based on the already achieved success, of the school's administration, which gave promise of critical support. A third was the presence at Curtis HS of a small cadre of teachers not only enthusiastic but experienced in the methods of Project Discovery, who could serve as catalysts for the other teachers. A fourth was the notable success of a pilot project in which, using Project Discovery techniques, teachers in an after school program at Curtis worked with students who had already dropped out of school, helping over 50% to graduate from high school and 30% to go on to college. This success suggested that the Project Discovery approach could also be highly effective in reaching the less interested or poorly motivated student, provided the curriculum is further developed and teachers are properly trained in the program.

Finally, although Project Discovery II would be unique in its emphasis on integrated, discovery based learning, it was similar in fundamental objectives and assumptions to a number of other current theories and successful experiments. The scholar Benjamin Bloom, for example, has long argued that upwards of 90% of students could "master" the materials of basic education. Mortimer Adler's Paedeia Proposal, now incorporated into several hundred schools nationwide, advocates a

common academic curriculum for all high school students. Some of Theodore Sizer's Coalition of Essential Schools attempt to achieve the same goal. The Project discovery II experiment offered a unique dimension in that it both endeavored to include below average students in a rigorous academic curriculum and attempted to do it by assuming that these students are not only capable of becoming self motivated learners but capable of understanding and being fascinated by the relationships between such disparate subjects as biology and world civilization.

However, given the admitted major differences in achievement and motivation between the Project Discovery I and Project Discovery II student populations, it was recognized that adaptations, even major changes in the original project would have to be made. In English, different readings had to be selected. Social studies and even science and math teachers had to learn how to assist in developing students' reading and writing skills within their regular courses. Attempts were made to incorporate developmental math into the curriculum to bring students up to level. It was recognized that activities which attract motivated students may not move the less motivated, and that these students might require more time to master a Regents biology course or a year of Regents math.

Project Description

Project Discovery II was organized and implemented along the same lines as the original Project. The specific plan of implementation was as follows:

1. The project required the full cooperation of both The College of Staten Island and the New York City public schools involved. Approval from the College President, the Provost, and the Vice President for Academic Affairs was secured. Because the project required substantial input from a variety of faculty members, the Dean of Science and Technology and the Dean of Humanities participated in planning and were consulted at each stage of implementation. The project was also endorsed by the principal of Curtis High School, by the Superintendent of High Schools for Brooklyn and Staten Island, and by the Chancellor of the New York City Public Schools. Sixteen teachers at Curtis High School, some of whom had worked on Project Discovery I, participated.

2. The project was planned to be developed incrementally over a period of three years:

a. In the first year a team consisting of the two Project directors from The College of Staten Island; four master teachers from Curtis High School already skilled in the Project Discovery approach, representing each of the four disciplines of Biology, Mathematics, Social Studies, and English; and eight additional teachers, two from each discipline, spent twenty days in August developing integrative units based on the discovery method as described above. The team worked with the math and reading/writing consultants to incorporate skills development into the exercises. In September the teachers began to implement these units with 4 classes of freshmen (30-35 students in each class). The students in these classes were selected at random from among those entering Curtis High School with below average reading and math scores. They were to be block programmed into the same core Regents

level academic courses, and the teachers worked as a team representing the four academic subjects. The College's experts in reading, writing, and math remediation were to work with the teachers on a periodic basis. Twice a month during the school year the College members of the team and the teachers held a two hour meeting after school to exchange ideas, assess progress, and modify or further develop programs as needed.

b. In the second year the same process and procedures was to take place except that a second group of teachers was to be added to see the first group of students through their sophomore year (Chemistry, Math, Global Studies II, English II), and a new group of freshmen was to begin the program with the original group of teachers. However, because of problems encountered in the first year (See **Evaluation/Project Results** below.), with FIPSE approval, year one was repeated and no sophomore group was included in the project.

c. In the third year the same process was again to be repeated except that a third group of teachers was to be added to handle the junior year Regents courses, with a third group of students inducted into the program. Thus, by the end of the third year the students would have completed a full three years in the program, providing a solid basis for evaluating its effectiveness. Similarly, by the end of the third year three teams of teachers would be in operation; and all would have had extensive experience working with each other. Instead, because of the problems encountered in year 1, in the third year the plan for the second year was implemented (See b. above.), and the third year plan was abandoned.

Evaluation/Project Results

First Year: In the project's first year a variety of problems stemming from the reality that Project Discovery II addressed itself to below average students were incurred which appear to help explain why these students fail and which seriously obstructed the smooth running of the project:

A. Summer: These problems first appeared during the intensive summer planning sessions that were meant to develop a viable curriculum for the first contingent of these students, a group of ninth graders. Participants in the sessions included the two College of Staten Island project Directors, four of the experienced teachers from the first Project Discovery, and twelve teachers new to the project (8 funded by FIPSE and 4 by the New York City Board of Education) who were to teach the first groups of below average ninth graders. In addition, because of the projected need for remediation in the target population, sessions included a math consultant and a professor from the College of Staten Island experienced in remedial English. The significant problems that first became apparent at these sessions were the following:

1. It immediately became clear that the teachers assigned to the target population of "below average" classes were as a group not of the same calibre as the teachers assigned to the "average" students of the first Project Discovery. These teachers tended to be either young and without experience or older but without notable achievement. With one marked exception, some seemed able to contribute little to planning the program and others seemed unwilling. What the Project Directors

had failed to take into account was a simple but very fundamental reality present in this school (and probably in most urban schools), namely, that despite regulations to the contrary, the best students get the best teachers, the average students get the next best teachers, and the below average students get the teachers least able to help them. This fact, obviously, posed an unexpected challenge to the project, one that could not be met with entire satisfaction during the summer planning sessions nor during the ensuing academic year.

2. A second unanticipated shortcoming became apparent when it was discovered that the students in this target population were not to be programmed as a block into mathematics. Based on their standardized math scores some would be placed in "Math Fundamentals", a course which assumes the student will never go on to algebra and other forms of higher math. Others would be placed in a "pre-Sequential Math" course preparatory to algebra and geometry. And a very few would actually take the high school level Sequential Math. Because of this it became impossible to integrate mathematics into the Project Discovery II program because the students, although together for the other three subjects, would be separated and with different teachers for mathematics. This was a particularly difficult problem to solve, especially since most of the target population had such a drastic need of remediation in mathematics if they were ever to graduate from high school at grade level.

3. A third problem arose out of the effort to develop an approach to remedial English for the target population. The teachers, led by those from the first Project Discovery who had developed a strong sense of independence, essentially rejected the remedial reading expert brought in from the College. They were not interested in hearing her ideas. As a result, the summer planning sessions did not develop a program to bring the target population up to level in language arts skills.

B. Academic Year: For the reasons indicated above, the Project Discovery II program was not ready to get off to an auspicious start at the beginning of the 1993-94 academic year. Discovery activities and interconnections between the disciplines had been developed sufficiently to carry through the first few lessons. However, due to the inexperience of some teachers and the indifference of others, the remainder of the year was yet to be planned; and the quality was very much in question. Further, because of the scheduling problem in math and the rejection of the remedial reading expert, no plan was in place to deal with the most glaring deficiencies in the Project Discovery II students. Further, additional problems developed in the school year itself:

1. The first was the fact that the New York City schools were closed for the first several weeks because of a widely publicized asbestos removal problem. The school year did not really begin until October amidst considerable confusion.

2. Second, it was discovered that the educational level of the target student population was even lower than had been anticipated. Perhaps the best evidence of this was the reading pre-test given to the students for project evaluation purposes. This was the same test that had been used successfully with the first Project Discovery students. However, the reading skills of the Project Discovery II students were so low that most could not even do the test. They found it so difficult that they simply gave up without trying.

3. Third, it was discovered that because school priorities dictated preferential scheduling for the better students, the Project Discovery II students were scheduled for their major classes (English, science, social studies, and math) in the afternoon, the part of the day when most students function at their lowest level. The low priority given to the needs of these below average students placed still another obstacle in the way of the Project's success, but certainly not the last to be encountered.

4. The last obstacle arose out of the block programming aspect of the project. The administration had agreed that students in the program would be block programmed so that each group of students would be taught by a single team of teachers. The students would move as a block from one teacher in the team to another. And, except for the problem with mathematics explained above, this was done at the beginning of the year. However, students in this below average nether world seem to be moved around, from class to class, as the year progresses and other needs arise. Thus, the membership of the original student blocks did not remained stable, presenting acute difficulties in maintaining a consistent program.

However, despite all the problems, the program was implemented as originally proposed, with the exceptions described above. Implementation was much more difficult than anticipated, and the road was far from smooth. Still, some positive signs did appear:

A. The first was that the program made some observable progress both as measured statistically and by observational evidence:

1. Statistically, attendance for the target population was 5.5% higher than for a comparable group, though grades showed no statistical difference. This suggests that students tended to find the Project Discovery classes more interesting, even though they did not do better in them academically.

2. Observationally, it was clear that teachers had in fact continued to develop discovery activities for the program, and did attend regular meetings to discuss ways of integrating the different subjects with one another. A few formed truly cooperative relationships. Some teachers also began to express a degree of enthusiasm for the effectiveness of the discovery approach. It may be the somewhat heightened involvement of the teachers that helped to raise attendance rates.

B. The second positive development was the fact that by the end of the first year it seemed that most of the logistical and structural obstacles would be removed before the second year began. This was to include:

1. Math would be included in block programming, with all students taking a specially designed "pre-Sequential Math" course geared to getting them "on line" into regular mathematics. This was to be developed over the summer months;

2. The teachers agreed to intensify their efforts at teaching basic English skills through a series of specifically language arts cooperative assignments involving the teachers of all the subjects. These were also to be developed over the summer;

3. The Principal agreed to maintain the integrity of the block programming by refusing to allow "left back" tenth graders to be dumped into these classes, and by minimizing the haphazard transfer of students from class to class

once the school year begins;

4. It was also agreed that the major subjects into which these students would be block programmed would be scheduled earlier in the day, between 10:00 and 1:00;

5. With regard to the problem of under-qualified teachers assigned to these students, it was decided to seek no changes. The rationale for this is presented below.

The experience of the first year suggested the advisability of modifying the original plan, which was to expand the program by training a new group of teachers to follow the original students into the tenth grade, while the original teachers took a new group of ninth graders. In reality, however, the original group of teachers had not made enough progress to leave them on their own while emphasis was placed on developing the skills of a new group. In addition, all the logistical and organizational problems of the first year had made it impossible for this first group of teachers to truly test the program. Finally, since the students who were in the program in the first year had not made enough progress either, it did not seem reasonable to think that they could be successfully followed into their sophomore year.

It was therefore recommended, and agreed to by FIPSE, that instead of expanding into the tenth grade, the second year of the project should repeat the first year, working with a new group of freshmen students, but with the same group of teachers.

Experience in the first Project Discovery clearly underlined the fact that a project like this succeeds if and when the teachers buy into it and begin to take ownership. They are the key. In the first project the teachers took hold during the first year, and by the second year were eager to take command, making it possible to move on to a second group of teachers. In the present project most of the teachers were only beginning to show meaningful interest. They were clearly not ready to go on their own. Because this group of teachers, as described above, was made up of persons who were either inexperienced or not highly motivated, the process of getting them deeply involved was taking much longer. In addition, all the other logistical and organizational problems described above had militated against success and tended to convince some in this group of teachers that nothing could be done.

Since it had become clear that school administrators generally, despite regulations to the contrary, were never likely to assign the best and most experienced teachers to these at risk students, it seemed advisable to continue working with the teachers already assigned to the project to test whether they could become more energized and effective in working with these students.

Therefore, the second year of the project essentially repeated the first year, with a different group of students but most of the same teachers.

Second Year: During the project's second year significant improvements were made, but not all the obstacles were eliminated:

1. The group of teachers working in the project congealed into a much more coherent and committed team. Several of the least able teachers from the first year did not wish to continue, and were replaced by more suitable colleagues. The

result was a much more dynamic effort, evident during the summer, 1994, planning sessions, and during the 1994-95 academic year.

2. By arrangement with the school administration, better scheduling gave the Project Discovery students a fair share of classes at more favorable times of the day, thus eliminating another obstacle to success.

3. The problem of block programming remained a continuing one: It proved impossible to overcome the obstacle posed by the students' great variations in math achievement levels. The mathematics department was unable to find a way to schedule the Project Discovery students into the blocks provided for the other three academic subjects. As a consequence, during the second year Project Discovery II had to limit itself once again to integration of social studies, English, and science, without math. This was considered a serious deficiency, but there appeared to be no viable solution within the organizational structure of this school. Math exercises, however, were woven into the block programmed subjects where possible, though these were not reinforced in the math classes themselves because students were dispersed among different classes representing three different levels of mathematics

In addition, during the fall semester, 1994, the effort at block programming in general broke down just as it had during the 1993-94 year. Despite the administration's good intentions and assurances to the contrary, as the semester wore on students were continually being shifted from class to class in defiance of their need to be block programmed. As a result, the fall semester was also largely a loss with regard to the effort to work intensively with an identifiable group of block-programmed students.

After something of a confrontation over this issue between the project participants and the school administration, a better arrangement was arrived at for the spring semester, 1995. Thus, during that semester for the first time in the project students were programmed at least in large part as the project design demanded. In fairness, it should be noted that the problem of keeping these below average students in consistent blocks is not in essence due to intransigence on the part of the school administration. Rather, it merely highlights the semi-chaotic conditions which prevail among students at this level. Drop outs, failures, and the like pose monumental problems for schedulers as they attempt to keep the school program running.

Despite the considerable flux in and out of the block programmed Project Discovery classes during the Project's second year, data were kept on comparative attendance rates, credit accumulation, and grades. These data, though distorted by the lack of continuity in the block programming, indicated that attendance was significantly better for the Project participants, but that credit accumulation and grades were actually better in the control group. This would appear to suggest that Project participants liked the program but did not benefit from it, a finding similar to that in the project's first year.

The fact that the control group actually did better than the participants is probably due to the fact, discovered after the fact, that many of the project participants came from the lower percentiles of this already below average group. Still, the data indicated that the Project did not seem to be having a particularly marked effect on

grades and credit accumulation.

Third Year: For the third and final year of the project, despite the lack of significant success in anything except attendance, it was decided to continue as planned, and target both the Project Discovery students who were now becoming sophomores and a new group of freshmen. The same summer planning and academic year planning and implementation took place. Many of the same problems encountered in years one and two had to be dealt with again: It was impossible to block program the Discovery students into mathematics. The same instability of class sections continued, as students were moved in and out of classes. This was especially detrimental to the sophomore group, many of whom were not the same students as those who had participated as freshmen.

In addition, another problem surfaced consciously-among the teachers, which had been present since the first year, but which had not been discussed openly. This was the fact that the behavior problem students inevitably filtered down into the below average classes which were the target for Project Discovery II. Once they reached these classes, they remained, since they could not be dismissed from school. In other words, problem students are removed from the more desirable classes and put in the least desirable ones. Teachers complained that they became an additional deterrent to Project Discovery's success. In these below average classes, which were already marginal, just one or two troublemakers could tip the scales.

Despite this difficulty, and the continuation of other difficulties reported on in previous years, the final evaluation report for project's third year, a complete copy of which is attached, found that some significant progress had in fact been made. As in previous years, attendance of Project Discovery students was significantly better than the control group. For the first time grades were also significantly better. Critical thinking skills were not significantly different, except for the ability to make inferences, which suggests the positive effect of discovery type activities, which tend to develop inferring skills. Writing skills were not significantly different. Interestingly, a measure of the students' attitudes towards science found that while control group students attitudes declined, Discovery students at least remained the same. No significant differences were found in career interests. (See attached "Evaluation Report" for details.) Thus, by the third year of the project more noticeable progress had been attained, particularly in the students' attendance and grades, though not enough progress for unbridled rejoicing.

A survey of the teachers, however, revealed much more dramatic success. It appears that the Project has made a lasting impact both on how they view themselves as professionals and the actual way that they teach. The teachers, some of whom had participated in the first Project Discovery as well, unanimously affirmed that participation had been a source of renewal for them as teachers. The project directors had been aware of the extent to which the teachers had taken to meeting with one another voluntarily to plan interdisciplinary exercises. This was an observable fact. It was not until the post-project interviews with the project evaluator, however, that it became apparent that the discovery approach to teaching had also taken deep root. In fact, many of the teachers now seemed so committed to it that they claimed to spend

time on a daily basis transforming their lessons to a discovery based format. See appended evaluation report for details. This was perhaps the most gratifying result for the project directors.

Largely because of their obvious enthusiasm for the discovery approach embodied in the project, and because of the dramatic success of the first Discovery project, despite the modest success of Discovery II the teachers are determined to continue even after funding. The school principal, too, probably influenced by the changes he has perceived in the project teachers, wishes to carry it on. Beginning in Spring semester, 1997, a group of average students will be block programmed with the experienced Project Discovery teachers on a permanent basis. Also in the Spring semester, 1997, and continuing into the summer, teachers in one, and possibly more, of the school's "houses" will begin planning for inauguration of the project discovery approach beginning in fall, 1997. This effort will be financed partly by CSI Discovery Center funds and partly by Curtis High School. The project for the below average students will also incorporate a special basic skills package which has already been developed by Curtis teachers.

It is felt that failure to put more emphasis on basic skills development in Project Discovery II was most probably the reason that only modest success was attained. The below average students obviously liked the project, but simply did not have the skills necessary to complete it with a high degree of success.

Because the Discovery Center will continue to work with the Discovery teachers at Curtis High school as the project becomes institutionalized as described above, the Center will continue to gather data and evaluate, with particular attention to the possible effects of a more concerted effort to teach basis skills.

The Discovery Center has applied for a FIPSE dissemination grant to introduce the project into three additional colleges and/or universities, with their respective neighboring high schools. It has also applied for a grant to incorporate the integrative, discovery approach into the CSI teacher preparation program, with a view to disseminating Project Discovery very widely as new teachers carry it into the schools where they teach.

Summary and Conclusions

Project Discovery II, as explained above, achieved a degree of success in working with below average students as measured by student outcomes, but not the kind of dramatic success achieved in Project Discovery I with average students. There are several possible explanations of this fact: 1) One is that the various factors described above which contributed to the lack of stability in the school's lower classes hindered success. 2) Another is that more concerted emphasis on basic skills would have been necessary to achieve success. 3) Still another is that for these students high school is too late, that action should be taken before they reach high school. 4) There is also the possibility that negative factors in the lives of these students outside of school make success impossible to achieve on any large scale.

Of these possible explanations, the Discovery Center, with Curtis High School, has chosen to pursue #2 at this time. It is hoped that the new package of basic skills

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activities, which have been developed as much as possible with a discovery approach to engender and maintain interest, will produce a result not achieved in the project itself. Time will tell. The Discovery Center also intends to pursue #3 by introducing the project into local elementary schools. A Middle School Initiative grant proposal for this purpose is pending.

With regard to the teachers involved, the project has been a resounding success. To the project directors' surprise, the teachers almost unanimously wax enthusiastic about both the interdisciplinary approach and the discovery method. Most profess that they have continued to develop these activities even on a daily basis. The obvious explosion in teacher enthusiasm and morale has no doubt been the most gratifying aspect of the entire project, and appears to be a lasting effect. This, too, will be monitored in the future.

Appendices:

(1) FIPSE, in the two Project Discoveries, has given as much help as we could possibly have expected. The FIPSE staff in general, and J. Donahue in particular, were available whenever needed, without being overbearing. We always felt a sense that we were trusted, and also that we did not have to try to hide the problems encountered in administering the project.

(2) Given the experience of this project, FIPSE might want to consider some of the following as possible directions in the effort to help higher education by producing better prepared high school graduates: a. possibly, particularly for struggling students, fund projects that concentrate on creative ways to teach basic skills in the pre-high school years; b. possibly fund similar projects which promise to empower and energize teachers; c.

(3) **Final Comment**: At the time we received our first FIPSE Project Discovery grant six years ago the Discovery Center at the College of Staten Island was only a name for an idea we hoped would lead to meaningful collaboration between the College and local schools. Today it has its own suite of offices in the College's main administration building; a staff of one full-time retired teacher, several part-time teachers, and three secretaries; the active collaboration of over 40 faculty members; and nine different grant-funded programs which reach over 20 schools, literally hundreds of teachers, and directly or indirectly thousands of students. The Center has been singled out in the College's new five year plan as a priority for further development.

All this may eventually have happened anyway, but we trace it directly to the status given our idea, and especially the opportunity to prove it could work, by FIPSE. We feel, therefore, that the FIPSE grants should not merely be evaluated on their single merits, but on the basis of their "seed" value in the growth of the CSI Discovery Center and its projects, all of which, by improving pre-college schooling, are contributing to the improvement of post secondary education. Thank you!

EVALUATION REPORT

DISCOVERY II

ACADEMIC YEAR 1995-96

David M. Podell, Ph.D.
November 26, 1996

Introduction

This evaluation report assesses the impact of Discovery II, implemented at Curtis High School, Staten Island, New York, in the 1995-96 academic year. The project was implemented in the ninth and tenth grades with three classes participating in the ninth grade two classes participating in the tenth grade. Many of the students in the tenth grade group had participated in the program in the prior year; however, because of student mobility and other factors influencing student placement, there was no exact match between ninth grade participants in 1994-95 and tenth grade participants in 1995-96.

For the purposes of the evaluation, a control group was identified consisting of two classes in the ninth grade and one class in the tenth grade. These classes were selected on the basis of their initial similarity to the participating classes.

In the present evaluation report, a variety of student outcomes are evaluated: (1) academic achievement, as measured by grade point average, (2) critical thinking abilities, (3) writing skills, (4) attitude toward a specific academic subject (science), (5) career interests, and (6) attendance. The impact of the Discovery II on each of these student outcomes is reported below, after which the results of the evaluation are summarized.

Academic Achievement

The impact of the program on students' academic achievement was assessed by comparing the grade point averages (GPAs) of students in the Discovery II program with that of their counterparts in the control group classes. In both grades, the mean GPA of Discovery II group students was significantly higher (F (1, 244)=11.78, $p<.001$) than that of control group students. In the ninth grade, Discovery II students had a mean GPA of 70.0 (SD=9.7), compared to the mean of the control group students, 65.0 (SD=10.0). Based on the standards of effect size identified by Cohen (1988), this difference represents a medium effect, namely, one half of a standard deviation. Comparisons of the median scores reveal the same pattern: Discovery II students' median GPA was 69.7, compared to the control group median of 65.6. The range of GPAs among Discovery II students was 52.0 to 89.9, as compared to the range of control group students, which was 38.1 to 83.5. The distribution of GPAs for ninth grade participants and non-participants is shown in Table 1 and illustrated in Figure 1.

In the tenth grade, Discovery II students had a mean GPA of 71.1 (SD=6.6), as compared to the control group mean of 68.8 (SD=5.9). This difference, which represents somewhat larger than one third of a standard deviation, represents a small-to-medium effect. The median of participating students was 70.0, while the control group median was 69.1. Finally, the range of participating students was 59.1 to 88.4, while that of the control group was 58.1 to 80.6. The distribution of GPAs for tenth grade participants and non-participants is shown in Table 1 and

illustrated in Figure 2. No interaction between group (Discovery II versus control) and grade was found; that is, no cumulative effect of a second year of program participation was detected.

Critical Thinking Skills

The critical thinking skills of the students were measured using the Watson-Glaser Critical Thinking Appraisal (1980), a standardized measure of higher-level thinking skills of students at the secondary and early post-secondary levels. The scale can be used as a single 80-item measure and can also be analyzed into five 16-item areas: inferencing, recognition of assumptions, deduction, interpretation, and evaluation of arguments.

In the evaluation of critical thinking skills, both participants and non-participants were pretested at the outset of the academic year and posttested at the end of the academic year. Comparison of the two groups on the pretest reveals no significant difference, Discovery II students having a mean of 39.3 (SD=6.4) and control group students having a mean of 39.0 (SD=4.0). Similarly, at the end of the academic year, no significant difference between the two groups was present. Discovery II students had a posttest mean of 40.3 (SD=7.0), while control group students had a mean of 43.7 (SD=5.5). Both groups had sufficiently high degrees of variability within groups to make this difference insignificant.

Another way to look at the scores of the students, however, is to compare their scores on each of the five areas of the scale (see Table 2). These comparisons yielded no differences on any of the subtests, with the exception of one. On the inferencing skills subtest, the Discovery II group, with a mean of 5.1 (SD=1.8), scored significantly lower than control group students, whose mean was 7.8 (SD=1.9). On the posttest, the scores of Discovery II students had increased significantly ($t=3.48$, $p<.005$) to 6.4 (SD=1.8), while the control group mean, 7.2 (SD=1.9), did not change significantly. This finding indicates that participation in the Discovery II project had a positive effect on participants' inferencing skills.

Writing Skills

A writing test was used to determine whether participation in the Discovery II program had an impact on their students' skills. Students in the two groups were given a writing assignment in which they were asked to take a position on a social issue (welfare) and write an essay describing their position. Discovery II and control group students wrote essays both as a pretest and as a posttest. Essays were scored on a holistic scale from one (very poor) to six (excellent) based on the quality of writing (i.e., clarity, logical flow, thoroughness, structure, depth of ideas). In a piloting of this procedure, two readers scored essays to ensure reliability; 92.0% agreement was reached in initial scoring and, after discussion of the inconsistent ratings, full agreement was achieved.

On the pretest, no significant difference was found in the scores of the Discovery II group (mean=2.0, SD=0.7) and the control group (mean=2.2, SD=0.8). Similarly, no difference was present on the groups' posttest scores, with the Discovery II group obtaining a mean of 2.5 (SD=0.8) and the control group obtaining a mean of 2.6 (SD=0.6). Thus, the program had no impact on students' writing skills.

Attitude Toward An Academic Subject

Students were surveyed to determine their attitudes toward a particular subject area. In order not to overwhelm students with the completion of surveys, one subject area, science, was selected. The scale consisted of twenty statements (e.g., "I like to read articles about science in magazines") to which students were asked to indicate their degree of agreement (or disagreement) on a five-item Likert scale from strongly disagree (1) to strongly agree (5). (Half the of the statements were written in a negative style to encourage students to read each statement carefully). Responses on each item were added to determine each student's total score. Both the Discovery II group and the control group completed the survey as a pretest and as a posttest.

Comparisons of the two groups' performance on the pretest revealed no significant difference in total score, with a Discovery II group mean of 66.6 (SD=11.4) and a control group mean of 71.7 (SD=10.8). The two groups also did not differ on the posttest, with the Discovery II group obtaining a mean of 64.6 (SD=12.6) and the control group obtaining a mean of 69.2 (SD=10.7). Thus, the program did not have an impact on students' attitude toward science.

However, the responses of the two groups were compared on an item-by-item basis and three significant differences were detected. All three items on which differences were found pertained to students' interest in science as a school subject (as opposed to a career path or a useful subject to understand). The three items were as follows: "I would enjoy taking an extra science course," "I avoid doing my science homework," and "Studying science is a waste of time." On each of these three items, the same pattern emerged: students in the Discovery II group maintained their same attitude from pretest to posttest, while the control group's attitude became more negative. Put differently, the Discovery II program appeared to have had a salutary effect on participants' attitude toward school science such that, although their attitude did not improve, it stayed constant. Non-participants, however, became more negative, suggesting that high school students' attitudes toward science becomes progressively more negative unless they participate in a program such as Discovery II. Scores for the overall attitude scale and for the three items mentioned are shown in Table 3.

Career Interests

Students' career interests were assessed by means of a ten-item survey. On this scale, each item was a statement (e.g., "In the future, I will want a job that is mentally challenging.") to

which students were asked to indicate their level of agreement (or disagreement) on a five-point Likert scale. Because different items pertained to different careers, a total score was not computed. As in the case of the attitude survey, the career interest survey was administered to both groups at the beginning and end of the school year.

Comparisons of the two groups on each item revealed no significant differences. The two groups' means scores were equivalent on each item on both the pretest and the posttest. The mean scores of both group are shown in Table 4.

Attendance

Attendance data for the two groups were obtained from school records to determine whether participation in the Discovery II program affected students' attendance. A significant difference (F (1, 244) = 16.26, $p < .001$) was found when Discovery II participants were compared to control group students, favoring the Discovery II group. Specifically, the mean number of absences among ninth grade students in the Discovery II project was 13.6 (SD = 10.4), while the mean for control group students was significantly greater, 23.5 (SD = 25.4). Among tenth grade students, the same pattern obtained. Discovery II participants had a mean number of absences of 10.1 (SD = 10.6), which was significantly less than that of the control group, 16.5 (SD = 16.2). In the case of both grades, the differences between the mean absences of the Discovery II group and the control group represent one half of a standard deviation, indicating a medium effect size.

The same pattern favoring the attendance of the Discovery II group emerges when the medians of both groups are compared. Among ninth graders, the median number of absences for Discovery II students was 11.0, while it was 17.5 for control group students. Among tenth graders, the median number of absences for students in the program was 7.0, while that of the control group was 12.0. The pattern is also evident in the ranges. Among ninth graders, program participants had between 0 and 51 absences, as compared to 2 to 134 among non-participants. Among tenth graders, Discovery II students ranged from 0 to 50 absences, while their control group counterparts ranged from 2 to 80. The distribution of absences is shown in Table 5 and illustrated in Figures 3 and 4.

Summary

This evaluation investigated the impact of Discovery II on a variety of student outcomes. Students who participated in Discovery II were compared to a control group of similar students. In many instances, pretest and posttest comparisons were performed. Favorable results were found in a number of the outcomes measured, while no impact was found on others. Specifically, the following results were obtained:

- The Discovery II program had a significant positive impact on the grade point averages of participating students. This difference represented a medium effect size.

- While the program was not found to have an effect on overall critical thinking skills or in four of the five critical thinking sub-areas, it did favorably effect students' inferencing skills.

- The program was not found to have an impact on students' writing skills, as measured by a holistically-scored essay.

- The program did not have an effect on overall attitude toward science; however, it did have a positive impact on students' attitudes toward science as a school subject. Specifically, Discovery II students' attitudes remained stable, while the attitudes of non-participants became progressively more negative. This finding suggests that participation in the Discovery II project appears to stem the tide of increasingly negative attitudes of high school students toward science as a subject of study in school.

- The Discovery II program did not have an impact on participating students' career interests.

- The program had a positive impact on students' attendance such that participating students attended school significantly more often than non-participants.

TABLE 1

DISTRIBUTION OF GRADE POINT AVERAGES (IN PERCENTAGES)

	Ninth Grade		Tenth Grade	
Grade Point Averages	Discovery II Group	Control Group	Discovery II Group	Control Group
Below 50	0.0	13.0	0.0	0.0
51-60	14.6	22.2	5.6	6.5
61-70	35.9	33.4	46.5	58.1
71-80	31.5	27.8	39.4	32.3
81-90	17.9	3.7	8.4	3.2
91-100	0.0	0.0	0.0	0.0

TABLE 2

CRITICAL THINKING SKILLS MEAN SCORES

Area	Discovery II Group		Control Group	
(80 items total; subtests have 16 items each)	Pretest	Posttest	Pretest	Posttest
Full Test	39.3	40.3	39.0	43.7
Inferencing	5.1	6.4	7.8	7.2
Recognition of Assumptions	9.2	9.2	9.4	8.2
Deduction	7.3	7.9	7.4	8.5
Interpretation	8.6	8.8	8.2	8.7
Evaluation of Arguments	8.6	8.3	8.0	8.7

TABLE 3

ATTITUDE TOWARD SCIENCE MEAN SCORES

	Discovery II Group		Control Group	
Items	Pretest	Posttest	Pretest	Posttest
Full Scale	66.6	64.6	71.7	69.2
"I would enjoy taking an extra science course."	2.2	2.2	2.4	2.0
"I avoid doing my science homework."	2.3	2.3	1.9	2.3
"Studying science is a waste of time."	2.3	2.4	1.8	2.1

Note: Higher scores indicate a greater level of agreement with the statement

TABLE 4

CAREER INTEREST MEAN SCORES

	Discovery II Group		Control Group	
Item	Pretest	Posttest	Pretest	Posttest
"I can imagine myself having a career as a teacher."	2.2	2.3	2.1	2.4
"I think it would be interesting to do work that requires mathematics."	2.8	2.6	2.8	2.7
"My primary interest in choosing a career is money."	3.7	3.5	3.4	3.5
"Science appears to be an exciting area to pursue in one's career."	2.7	2.8	2.9	2.8
"I have had some teachers over the years who have inspired me to be a teacher myself."	2.4	2.5	2.4	2.6
"In the future, I will want a job that is mentally challenging."	3.3	3.5	3.5	3.6
"I think that medicine would be a challenging field to go into."	3.4	3.6	3.9	3.9
"I plan to pursue a career that allows me to help others."	4.0	4.0	4.2	4.0
"I would like to have a career that gives me the opportunity to write."	2.9	2.8	3.0	3.0
"In my career, I would like to make some kind of contribution to society."	3.7	3.6	3.8	3.8

Note: Higher scores reflect higher level of agreement to the statement.

TABLE 5

DISTRIBUTION OF ABSENCES (IN PERCENTAGES)

	Ninth Grade		Tenth Grade	
Number of Absences	Discovery II Group	Control Group	Discovery II Group	Control Group
0-10	49.4	35.2	60.6	38.7
11-20	25.8	22.2	28.2	41.9
21-30	16.9	20.4	5.6	6.5
31-40	4.5	7.4	1.4	6.5
41-50	2.2	7.4	4.2	0.0
51-60	1.1	1.8	0.0	3.2
>60	0.0	3.7	0.0	3.2

Figure 1

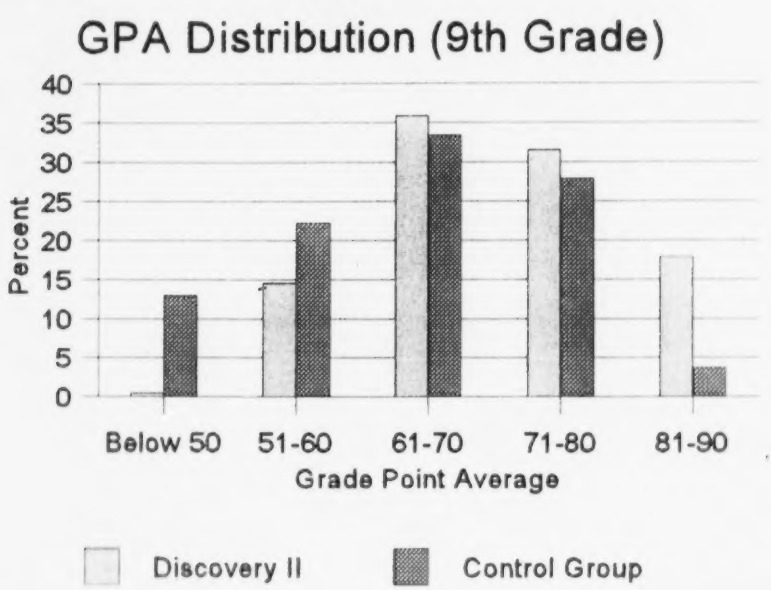

GPA Distribution (9th Grade)
40
35
30
25
20
15
10
5
0
Percent
Below 50
51-60
61-70
71-80
81-90
Grade Point Average
Discovery II
Control Group

Figure 2

GPA Distribution (10th Grade)

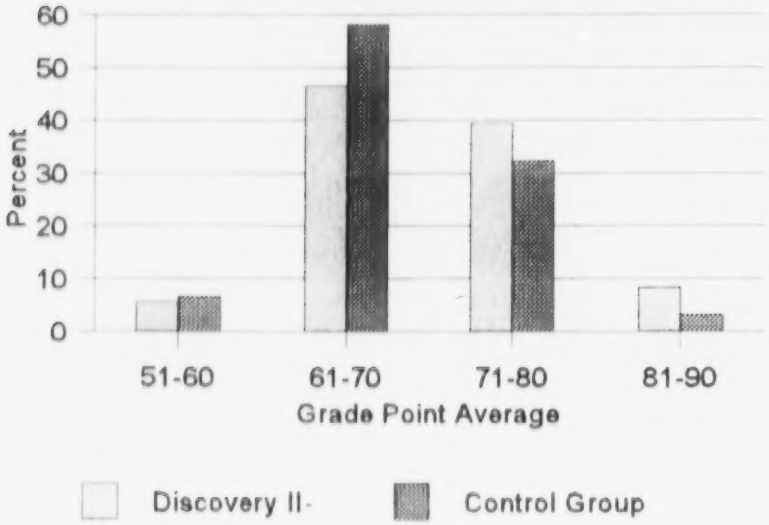


Figure 3

Absences (9th Grade)

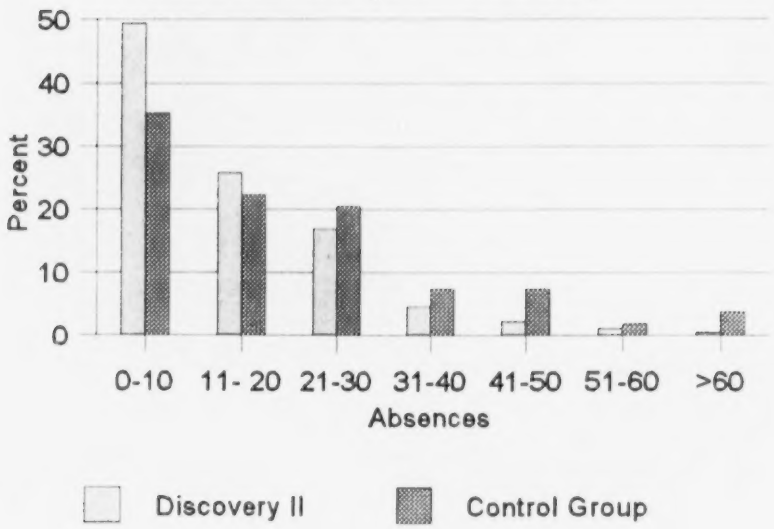
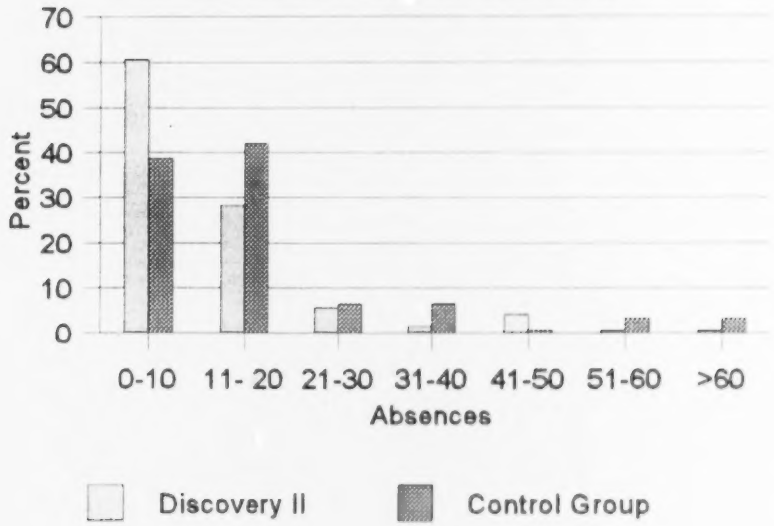


Figure 4

Absences (10th Grade)



EVALUATION REPORT

PROJECT DISCOVERY

INTERVIEWS WITH PARTICIPATING TEACHERS, CURTIS HIGH SCHOOL

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This evaluation report is based on a discussion between the evaluator and eleven teachers who are participating in the Discovery project. The teachers varied in the number of years that they have been involved in Discovery Center projects from less than one year to eight years. The teachers' subjects included social studies, science, mathematics, and English. Their comments are presented topically to highlight their perceptions of the project's impact on them and on their students.

Interdisciplinary, Discovery-Based Teaching and Learning

The participating teachers praised both the interdisciplinary nature of teaching and the discovery-based approach to learning, both of which are part of the Discovery project philosophy. They described interdisciplinary teaching as "a more natural connection" between subjects and "a more accurate portrayal of the world." They indicated that developing an interdisciplinary approach was by no means easy, but that the payoff was considerable. One teacher indicated that "making connections between the fields highlights the value of knowledge" to the students, who are not left wondering why they are learning particular content. The teachers indicated that this was particularly important for low-achieving students, who may lack self-motivation and who need to see more distinctly the value of their efforts.

The discovery-based approach to teaching and learning was also universally endorsed by the teachers, who indicated that they believed that *all* students could benefit from this approach to instruction. They reported that, using a discovery-based approach, students became more active in their learning and became more responsible for their own learning. Teachers repeatedly used the word "transformation" in describing what they witnessed in participating students, as well as in themselves.

Effect on Teachers

When asked to describe the way in which participation in the project influenced them as teachers, the participating teachers noted a number of notable effects. Firstly, they indicated that participation in the program prevented the typical isolation of new teachers. By being linked to

a cadre of teachers in other disciplines, new teachers who were participating in Project Discovery automatically had a small group of teachers who could act as mentors and who could support them in their first teaching assignment. In addition, both novice teachers and experienced teachers had the opportunity to develop connections with colleagues across departments. Typically, they explained, teachers worked with each other within a specific area (e.g., social studies) and had only passing relationships with teachers in other areas. Through their participation in Project Discovery, they were able to develop fruitful professional relationships with colleagues in other disciplines, thereby obtaining professional support while at the same time expanding their own knowledge and developing effective collaborations.

The teachers also observed that, during their participation in the program, they developed collaborative skills. They indicated that, at the outset, they did not know *how* to work collaboratively. The design of the project and the assistance of the Project Discovery college faculty promoted their learning *how* to collaborate. They noted that these collaborative skills have already been useful and will in the future be generalizable to a variety of situations in which they have opportunities to work collegially.

As a result of their participation in the project, the teachers developed better teaching skills, they report. They also learned to how to relate their own areas to other fields, as well as to students' own lives. They felt that they now understood the relationship between their fields and others and were consequently better able to justify their curricular goals to students.

The teachers claimed that their participation changed how they perceived their students. Specifically, they noted that the program "broadens the landscape" such that they no longer saw a student as an isolated performer in a single class. Rather, they now considered the student as a learner across many subjects. This new perception of the students, they felt, contributed to an improved relationship between the teachers and students.

Fundamentally, the project changed how they teach. They noted that the discovery-based approach to teaching requires teachers to surrender the complete control that they have when following a more traditional approach to teaching. To do this, they have to be confident both in their ability as teachers and in their knowledge of the material. The teachers highlighted the importance of planning: for discovery-based lessons to be successful, teachers must spend

considerable time working out in their own minds the problem they wish to present to students and how they will encourage students to solve the problem. They have to be flexible such that they can move wherever the direction of the lesson takes the class. They have to recognize that, unlike a lesson where the outcome is clearly defined, a discovery-based lesson may lead to an unexpected avenue. While such situations can be exciting, they can also be anxiety-provoking and, they note, teachers following this approach need to be ready to adjust to the direction that the students take the class. In essence, they must learn to live with uncertainty and learn to think on their feet. Finally, they must unlearn their old approach to teaching and embrace a different philosophy, one that defines an entirely different role both for them and for their students.

The more experienced participating teachers expressed great satisfaction in their mastery of the discovery-based approach. They noted both this approach "requires more ingenuity," but, compared to traditional methods, is "far more satisfying." One teacher described her "rebirth" as a teacher. When she began participating in Project Discovery, she had taught for many years and had "perfected" her lessons, which she felt were satisfactory, although predictable. When she began adopting a discovery-based, interdisciplinary approach, she felt that she became recharged and that her teaching had renewed purpose and a significantly more positive impact on her students. She advocated this approach for all experienced teachers who feel stale in their work; she predicts for them a professional "rebirth" similar to her own.

Impact on Students

Asked to describe the impact of Project Discovery on their students, the teachers noted its positive effect on both their motivation and their achievement. They indicated that participating students actively want to obtain more knowledge; "they want to find out for themselves," said one. The teachers were impressed that many of the students made the connections between subjects by themselves. "They find something in the learning for themselves," noted one teacher. They observed that students who are not typically receptive became significantly more interested in learning as a result of Project Discovery's approach.

Participating teachers felt that the discovery-based, interdisciplinary approach led to them reaching a broader range of students. The students appeared to be more comfortable in a discovery-based classroom. A number of reasons were offered for this transformation. Firstly, the program effectively reduced the size of the school for the students. They were now involved with a narrower group of teachers and students and therefore felt more connected. Secondly, while in a traditional model of learning, students are either "winners" or "losers," while in a discovery-based model of learning, all students have the opportunity to succeed. They are therefore more eager to participate and do so with greater confidence. The teachers observed that the students themselves made a greater commitment to learning. Student achievement was consequently greater: a greater number of students learned a greater amount of knowledge, teachers felt.

Obstacles

The participating teachers were asked to identify obstacles to the successful implementation of the project. The biggest obstacle they noted was school programming. They felt that the forty-minute period was too confining for discovery-based lessons. They indicated that an hour would be a more appropriate amount of time to complete a discovery-based lesson.

Participating teachers also indicated that classrooms dedicated to Project Discovery classes would be helpful. Short of that, they indicated the usefulness of being able to restructure rooms and other school facilities. The stressed the importance of desks and tables being movable such that rooms could be redesigned to meet the needs of a particular activity. Asked if the availability of materials was a problem, the teachers indicated that this was not the case and that appropriate materials were available to them.

Benefits

The teachers were asked to indicate what they perceived as the benefits of the project. Many teachers emphasized the value of greater teacher interaction. They indicated that they now

perceived collaboration with other teachers to be an invaluable resource to them in their professional lives.

Many also noted the value of the interaction with the college faculty who coordinated the program. They indicated that the college faculty never said, "This is what you should do." Rather, "they suggested a way of thinking about the material and said 'You own it.'" This approach applied the precepts of discovery learning to the teachers themselves, helping them, in turn, apply it to their lessons with their students. The teachers reported that this approach brought out the talent of the teaching staff. They described the "unleashing of energy and ideas" in their faculty.

Teachers also noted the benefits of the "shrinkage of the school" that occurred through the implementation of the Project Discovery approach. They praised the more personal relationships that developed between teachers, between students, and between teachers and students. Others were gratified that parents reported greater awareness of their children's learning.

Many noted as the most important benefit the effect on their role. They described their redefined role: "I'm no longer an information giver; now I'm an orchestra leader." They observed a shift in the distribution of their work such that they now spent more time outside the classroom preparing for their lessons. Further, they observed that, when lessons do not go as planned, they still "go somewhere." One teacher remarked, "You may not get to your destination, but the journey becomes more important than the destination." However, they indicated that, more often than not, the lesson indeed goes where the teacher intended.

Teachers also noted the value of the program to the students. "A different phenomenon occurs in the classroom," one teacher suggested. "Students get a better sense of recurring issues -- they develop a better understanding, using vocabulary in four different contexts." The discovery-based approach to teaching promotes a new way of thinking for students, one in which they must solve problems collaboratively with their peers and with the consultative assistance of their teacher. This approach goes against students' prior conditioning. "At first, they say 'Tell me,'" reports one teacher. "Then, they want to figure it out for themselves."

Negative Outcomes

The participating teachers were asked to identify possible negative outcomes of participation in the project. The teachers indicated concern that some participating students may miss some of the questions on the state-wide Regents examination. Using a discovery-based approach, they noted, there can be the tendency for the class to go on tangents and not cover enough content. They observed that, as the Regents examination loomed closer, teachers rushed to cover more content, sometimes reverting to a more traditional approach to teaching. Nevertheless, most teachers in the group agreed that the Project Discovery approach is "the best possible way to prepare for the essay [portion of the Regents examination]." No other negative outcomes were noted by the participating teachers.

Suggestions for the Future

The teachers recommended that the project be expanded to include many more teachers and students. "The majority could benefit," noted one teacher. Another teacher noted the importance of including brand new teachers in the project, before they develop "bad habits" and embrace a more traditional approach to teaching. They also recommended the interdisciplinary, discovery-based approach to more experienced teachers. "Some experience with the Project Discovery method would change the minds of traditional teachers" and broaden their view of their work.

The participating teachers enthusiastically endorsed the continued use of the interdisciplinary, discovery-based approach to teaching and learning that they had adopted. In general, they described the approach as challenging and, at times, difficult; but, unanimously, they recognized the value of the approach both to themselves and to their students. They indicated that, having learned the discovery method, there was no going back to a traditional approach for them. One teacher noted "It would be counterproductive to go back to a method that works somewhat well for very few students when I've learned a method that works extremely well for a broader range of students."